AF4: 2020/2021
Performance measure and evaluation

The milestones for this part are to understand:

- How to calculate and interpret Holding Period, Money Weighted and Time Weighted Returns and know when it is appropriate to use each one.
- How to calculate and interpret Alpha
- How to calculate and interpret the Sharpe and Information Ratio
- How to analyse the performance of a multi fund portfolio against its benchmark.
- The principles of rebalancing

The question that every client asks is what return can be expected. Whilst this can't be answered a realistic target should be set as a benchmark.

An individual fund and its manager can be assessed against an index which must be relevant to the fund. The performance of an equity fund should not be compared to a gilt and bond one. Indices have some limitations:

- Market weighted indices will be dominated by a small number of large companies
- They reflect changes in capital value and don't take into account dividend income
- They don't take into effect the costs of buying and selling.

Assessing performance against an index might push managers into being "closet trackers" buying the securities that drive the index. It would be a brave manager whose benchmark was the S&P 500 not to have Amazon, Facebook and Alphabet (Google) in the fund

Performance against the target/benchmark can be assessed after 12 months. This can be measured in three main ways:

- Absolute returns
- Relative returnsund
- Risk adjusted returns

Absolute Returns

These give the return on an asset or security usually over a 12 month period.

There are three methods of calculation:

- Holding Period Return
- Money weighted Return
- Time weighted return

Holding period return

The formula is:

$$\frac{\text{(Closing value less opening value) + dividend}}{\text{Opening Value}} \times 100$$

A portfolio of shares has a value on January 1 of £10,000. During the year, it pays £400 in dividend and at the end of the year it has increased in value to £11,000.

Therefore:

$$\frac{\text{£11,000 - £10,000) + £400}}{\text{£10,000}} \times 100 = 14\%$$

Money Period Return (MPR)

Let's suppose that in the above example the investor added a further £10,000 on July 1. The dividend stays the same but at the end of the year the portfolio was worth £22,500.
If we use the HPR formula we would get the following:

$$\frac{\text{(£22,500 - £10,000) + £400}}{\text{£10,000}} \times 100 = 129\%$$

A brilliant return but the fund manager can claim little credit as the figure has been distorted by the introduction of new money.

To get around this problem we use the **Money Period Return (MPR).** The MPR formula is a little more complicated but let's takes it in easy stages. We need the following information about the portfolio:

- Opening value (v0)
- Amount of new money invested (C)
- Period (usually shown as number of months) new money was available. (n)
- Closing value (v1)

The formula is:

$$\frac{(v1-v0) - C}{v0 + (C \times n/12)}$$

Note that we deduct the amount of new investment on the top line.

Opening value January 1 £10,000
New money added £12,000 on July 1
Value at 31 December £24,000

$$\frac{(£24,000 - £10,000) - £12,000}{£10,000 + (£12,000 \times 6/12)}$$

Which is:

$$\frac{£2,000}{£16,000} \times 100 = 12.5\%$$

If money is taken out the formula is:

$$\frac{(v1-v0) + C}{v0 - (C \times n/12)}$$

The money taken out, C, is added to the top line. N is the number of months the money wasn't invested and subtracted in the bottom line.

Simon had a portfolio with a value of £30,000 on January 1. £12,000 was withdrawn on September 1 and the value on December 31 was £22,800

$$\frac{(£22,800 - £30,000) + £12,000}{£30,000 - (£12,000 \times 4/12)}$$

$$\frac{£4,800}{£27,000} \times 100 = 17.78\%$$

If dividends had been paid, these would be added to the top line.

Time weighted return

Let's suppose that in the first 6 months a fund grew by 20% from £10,000 to £12,000 which encouraged the investor to put in another £10,000. Unfortunately, performance in the second half of the year wasn't as good and ended with a value of £22,500.

MWR does not reflect this slow-down in performance so there is a third method called the **Time Weighted Return (TWR)**. To calculate it we also need to know what the value of the portfolio was when new money was invested.

January 1	£10,000
July 1	£12,000 + £10,000 = £22,000
December 31	£22,500

The first step is to calculate the holding period return for each period

Period 1: £12,000 - £10,000/£10,000 = 0.2
Period 2 £22,500 - £22,000/£22,000 =0.022

The next step is to add 1 to each figure and multiply them together:

1.2 x 1.022 = 1.2264

The final stage is to deduct 1 and multiply by 100.

1.2264 minus 1 = 0.2264
0.2264 x 100 = 22.64%

In all the previous examples a positive return has been achieved but the formulas could produce a negative return if the value of the asset or security was lower than the original amount at the end of the period.

Which should be used?

- **HPR** is a simple calculation but only useful if no money has been introduced or withdrawn during the year

- **MPR** is used to calculate the return if new money is introduced or withdrawn during the year.
- It gives misleading results if used to compare the performance of two different fund managers.

- **TPR** is used to compare the performance of one manager against another as it is not affected by cash flows in or out of the fund

Performance Comparisons

Absolute measurements do not show the relative performance. For example, an annual return of 6% may look reasonable but if another manager has achieved 8% it is not as impressive.

The main comparative measure is **alpha**. This measures the performance against the expected return usually indicated by the **capital asset pricing model.**

The expected performance of a fund as measured by its CAPM is 4%. If the actual return is 6% then the alpha is 2%
If the actual return had been 1% then the alpha would have been minus 3%

Rather than use the CAPM output, alpha could be the difference between the actual result and a target or the performance of an index.

In summary:

- Alpha measures the performance of the fund manager against the expected return as measured by CAPM or some other measure
- It can be positive or negative.
- A positive return indicates the manager has added value.
- A negative return indicates that the manager has not added value

Risk adjusted returns

The return achieved is influenced by the amount of risk that was taken. However, if the manager decides to take more risk, is that being delivered in an increased performance? The following measures will help to quantify this

- The Sharpe ratio
- Information ratio

Sharpe ratio

Manager A has produced a return of 15% whereas manager B has a return of 12%. On the face of it manager A has had the better performance but if A took much higher risks than B, it may be the case that B has had a better risk adjusted return.

The Sharpe ratio enables us to compare the two. The formula is

$$\frac{\text{Return} - \text{risk free return}}{\text{Standard deviation of the portfolio}}$$

Risk free return is usually the return on Treasury Bills which for this example we'll take as 1%

In comparing these two managers we've found out that A's standard deviation was 8% whereas with B it was 5%

Manager A

15% - 1% = 1.75
8%

Manager B

12% - 1% = 2.2
5%

We can conclude that manager B generated a higher return on a risk adjusted basis. The purpose of the ratio is to see how much additional return you are receiving for each unit of risk.

It is considered that a ratio between 1 and 2 is good; between 2 and 3 is very good and more than 3. The Sharpe Ratio is usually positive but could be negative if the fund performance were less than the risk-free return

The Information Ratio

The formula is:

Portfolio Return less Benchmark return
Standard Deviation of Tracking error

The bottom line is often referred to simply as the Tracking Error.

The best way to understand it is to show an example

Year	Portfolio Performance (A)	Benchmark Performance (B)	Excess Return A-B
1	5%	3%	2%
2	-2%	-4%	2%
3	5%	2%	3%
4	-3%	-5%	2%
5	25%	23%	2%
6	8%	8%	0%
7	4%	6%	-2%
8	2%	-3%	5%
9	5%	3%	2%
10	5%	5%	0%
Mean return	5.2%	3.5%	
SD of excess returns			1.9%

The average return of the portfolio over 10 years is 5.2%
The average return of the benchmark fund over 10 years is 3.5%
The mean of the difference in returns has been calculated together with the SD to give 1.9%

The information ratio is $\frac{5.2\% - 3.5\%}{1.9\%} = 0.86$.

A manager of a similar fund might also have achieved an average return of 5.2% against their selected benchmark of 3.5%. However their annual returns tended to differ more widely from the benchmark, in other words their returns were more volatile. As a result the SD of the average difference was 5.44%

The IR would be $\frac{5.2\% - 3.5\%}{5.44\%} = 0.3125$

The average return of the portfolio over 10 years is 4%
The average return of the benchmark fund over 10 years is 5.2%%
The SD was 3.4%

The information ratio is $\frac{4\% - 5.2\%}{3.4\%} =$ minus 3.53

What does the information ratio tell us?

From the above example it's possible to deduce the following:

- The IR can be positive or negative
- As the IR is calculated over a number of years it tells us whether the portfolio has outperformed its benchmark over that period. (in the first example it has) In other words the **consistency** of the under/over performance.
- It tells us the volatility of the portfolio against its benchmark

The Information Ratio is often described as a **risk related performance indicator** and I've included in that section alongside the Sharpe ratio. In some senses it isn't really risk related since to be accurate the selected benchmark should carry the same level of risk as the portfolio. It is risk related in that it compares the volatility of the portfolio against the benchmark.

The April 2019 paper had a question, "Explain the information ratio to Beth"

The answer given was:

- Show the performance against a benchmark
- Assesses risk adjusted returns
- Shows the under/over performance
- Shows the consistency of the manager

Interpreting IR

IR is designed to assess the consistency of a fund manager. The higher the IR the more consistent the performance. As a general rule:

- A positive IR is considered to be an above average performance
- 0.5 is considered good
- Above 1 is exceptional

Portfolio evaluation and analysis

A typical portfolio will be invested in different sectors and each will contribute to its overall performance. This will be determined by:

- the percentage held in each class
- the return for each class

A portfolio is split 60% in shares and 40% in Bonds. The return made on shares was 8% and 1% on Bonds. To calculate the contribution made by each sector the percentage is multiplied by its return.

The total return would be calculated as follows

Sector	Percentage	Return	Contribution
Shares	60%	8%	4.8%
Bonds	40%	1%	0.4%
Total			5.2%

If the split has been reversed (40% shares, 60% Bonds) the overall return would be:

Sector	Percentage	Return	Contribution
Shares	40%	8%	3.2%
Bonds	60%	1%	0.6%
Total			3.8%

In the second example a lower return was produced because the majority of the fund was held in an underperforming asset.

A multi asset portfolio can be measured against a target or benchmark. This tells us whether the portfolio over or underperformed the target. By doing further analysis it's possible to establish of much of the return was down to the manager's asset allocation and how much was down to their stock picking skills.

To do this a model portfolio has to be selected as the benchmark. This should reflect the client's objectives and risk profile. If the client's aim is to get growth and is prepared to

accept a high level of risk, it would be inappropriate to compare this to a portfolio that aimed to produce an income with a medium level of risk.

The Investment Association produces different model portfolios based on objectives and risk. This will give a weighting to each sector and designate an appropriate index for each For example the UK equity sector might use the FTSE 100 index, FTSE 250 or FTSE All-Share.

The chosen benchmark has the following asset allocation and the relevant index has produced returns as shown.

Sector	**Benchmark allocation**	**Performance (Index)**	**Contribution**
UK Equities	55%	10%	5.5%
Overseas Equities	25%	6%	1.5%
Fixed Interest	15%	1%	0.15%
Property	5%	3%	0.15%
	100%		7.3%

Therefore, if the portfolio manager had chosen the same allocation and achieved the same return, they would also get a return of 7.3%.

The Portfolio manager decided to have a different split as follows:

- UK equities (45%)
- Overseas equities (30%)
- Fixed Interest (20%)
- Property (5%)

Whilst the weighting in property was the same, compared to the benchmark, the manager was underweight in UK equities and overweight in overseas equities and fixed interest.

At the end of the year the contribution made by each part of the portfolio is calculated by multiplying the percentage for each sector by its growth (or fall). These are then added up to give the total return.

Sector	**Portfolio allocation**	**Portfolio performance**	**Contribution**
UK Equities	45%	8%	3.6%
Overseas Equities	30%	15%	4.5%
Fixed Interest	20%	1%	0.2%
Property	5%	5%	0.25%
	100%	100%	8.55%

The portfolio returned 8.55% so outperformed the benchmark by 1.25%. That's good but we can now analyse how much of this was die to asset allocation and how much was by the

manager's stock selection.

To assess the effect of **asset allocation,** the **benchmark's return** is applied to the **portfolio allocation.** In other words, we are calculating the return the Benchmark would have made if they had used the portfolio's allocation. This is then compared to the Benchmark's return.

Sector	**Portfolio allocation**	**BM return**	**Contribution**	**Original Benchmark contribution**	**Difference**
	A	**B**	**C (A x B)**	**D**	**C-D**
UK Equities	45%	10%	4.5%	5.5%	-1%
Overseas Equities	30%	6%	1.8%	1.5%	0.3%
Fixed Interest	20%	1%	0.2%	0.15%	0.5%
Property	5%	3%	0.15%	0.15%	0
	100%		6.65%	7.3%	-0.65%

This shows choosing to be underweight in the best performing sector, UK equities, cost the portfolio manager 1% which wasn't offset by being overweight in the other sectors.

To assess the manager's **stock picking skills**, we apply the **portfolio return** to the **benchmark allocation** and compare this to the return made by the benchmark.

Sector	**BM allocation**	**Portfolio return**	**Contribution**	**BM return**	**Difference**
UK equities	55%	8%	4.4%	5.5%	-1.1%
Overseas equities	25%	15%	3.75%	1.5%	+2.25%
Fixed Interest	15%	1%	0.15%	0.15%	0%
Property	5%	5%	0.25%	0.15%	+0.1%
	100%		8.55%	7.3%	1.25%

By applying the portfolio's return to the BM allocation the portfolio manager outperformed the BM by 1.25%. This shows that the manager's stock picking skills were superior to the indices used by the bench mark.

Portfolio rebalancing

Portfolio evaluation also helps in rebalancing the portfolio at the end of the year. If £100,000 had been invested in the portfolio the original allocation would have been as follows:

Sector	Portfolio allocation	Amount invested	Growth	Year end value	Year end %
UK Equities	45%	£45,000	8%	£48,600	44.77%
Overseas Equities	30%	£30,000	15%	£34,500	31.78%
Fixed Interest	20%	£20,000	1%	£20,200	18.61%
Property	5%	£5,000	5%	£5,250	4.84%
Total		£100,000		£108,550	100%

Due to the better performance of the overseas equities the percentage has increased from the original 30% whilst the percentage of the others has reduced. In this example the change is quite low but whether some of the overseas equities should be sold and securities in the other sectors purchased should be discussed with the client. This is a mandatory requirement of the FCA.

That concludes this part so you should now understand:

- How to calculate and interpret Holding Period, Money Weighted and Time Weighted Returns and know when it is appropriate to use each one.
- How to calculate and interpret Alpha
- How to calculate and interpret the Sharpe and Information Ratio
- How to analyse the performance of a multi fund portfolio against its benchmark.
- The principles of rebalancing